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Report on the Tenth United Nations/Sweden International Training Course on Remote Sensing Education for Educators

(Stockholm and Kiruna, Sweden, 2 May-9 June 2000)

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I. Introduction

A. Background and objective

1. The Tenth United Nations/Sweden International Training Course on Remote Sensing Education for Educators, held in Stockholm and Kiruna, Sweden, from 2 May to 9 June 2000, was organized by the United Nations Programme on Space Applications of the Office for Outer Space Affairs of the United Nations Secretariat in cooperation with the Government of Sweden as part of the 2000 activities of the Office for Outer Space Affairs. As was the case for the nine previous courses in the series, the course in 2000 was conducted specifically for the benefit of educators from developing countries with the objective of enabling them to introduce remote sensing courses in their respective academic institutions. It was co-sponsored by the Swedish International Development Cooperation Agency (SIDA) on behalf of the Government of Sweden and was hosted by the Department of Physical Geography of the University of Stockholm in Stockholm and by Satellus AB (formerly Satellitbild SSC), which is part of the Swedish Space Corporation, in Kiruna.

2. The present report describes the organization of the training course, its technical contents, the results of the course evaluation and the proposed follow-up action. It has been prepared for submission to the Committee on the Peaceful Uses of Outer Space at its forty-fourth session and to its Scientific and Technical Subcommittee at its thirty-eighth session, in 2001. Participants reported on the knowledge acquired and the work conducted during the course to the appropriate authorities of the Government, universities and research institutions in their respective countries.

B. Organization and programme

3. Application forms for and information brochures on the training course were sent out in early December 1999 by the Office for Outer Space Affairs to the permanent missions to the United Nations of 51 developing countries. Copies were also sent to the local offices of the United Nations Development Programme in those countries for transmission to the relevant national authorities. The same materials were also distributed simultaneously to relevant Swedish embassies and to previous course participants for circulation in their academic institutions. One hundred and forty-one completed applications from 36 countries were subsequently received and processed jointly by the Office for Outer Space Affairs and the University of Stockholm.

4. Twenty-six candidates, 9 of them women, were selected as participants from the following 23 countries: Angola, Bangladesh, Brazil, Chile, Costa Rica, Dominican Republic, Ethiopia, Ghana, Guyana, Kenya, Lao People's Democratic Republic, Malawi, Nepal, Nicaragua, Pakistan, Panama, Senegal, Sri Lanka, Uganda, United Republic of Tanzania, Viet Nam, Zambia and Zimbabwe. Funds for the international travel of 13 participants were provided from the fellowship budget of the United Nations Programme on Space Applications. Support for the international travel of the remaining 13 participants, as well as the cost of room and board, course materials and inland transport for all 26 participants, was provided by the Government of Sweden. The European Space Agency (ESA) financed the participation of one course instructor.

5. Course instructors and speakers came from several institutions, including the Office for Outer Space Affairs, ESA, SIDA, the University of Stockholm, the Swedish Royal College of Technology, the University of Uppsala, the Swedish National Space Board, the National Land Survey of Sweden, the Environmental Satellite Data Centre, I. & I. Monitor and Satellus.

II. Summary of the contents of the Course

6. Except for minor modifications to reflect technological advances and feedback received during annual course evaluations, the content and structure of the course have not changed significantly over the years. The course is modular in format and consists of a series of lectures and office and field exercises. A more detailed summary of the contents of the course can be found in the report on the fifth course in the series (A/AC.105/617).

7. The first technical module of the course lasted three days and dealt with the fundamental principles of remote sensing. The principal topics covered were the following: electromagnetic radiation, the reflective properties of various types of materials on the surface of the Earth and elementary optics; electronic imaging; georeferencing of objects in the field, on maps and on satellite imagery; and Earth resources and environmental satellites.

8. Five days were subsequently devoted to image interpretation and presentations on the following subjects: remote sensing for land use planning and environmental monitoring; remote sensing for geological studies; and introduction to visual interpretation and in-service training in developing countries.

9. To reinforce understanding of the principles of image interpretation, participants were divided into groups on a regional basis; each group studied a case where visual interpretation of satellite images played a key role.

10. The next series of lectures dealt with digital image analysis and geographic information systems (GIS). That aspect of the programme lasted six days and covered the following subjects: digital analysis (theory); computer image enhancement (theory); GIS theory; and digital image processing techniques, including computer-aided analysis, GIS applications, CD-ROM data capture, compass techniques and global positioning systems (GPS).

11. The participants were also introduced, over a period of four days, to the principles of radar image formation and the use of such images in various development and research applications. In addition, they were introduced to the use of appropriate procedures for the field verification of interpretations of remotely sensed data using satellite images of the Skinnskatteberg area in southern Sweden.

12. The next part of the course was held in Kiruna, at the facilities of Satellus. Four days were reserved for visual interpretation in project planning exercises and presentation of results. Wherever possible, these exercises were carried out on images selected by the participants of areas of their countries with which they were familiar. Lectures were also presented on the following subjects: archiving, catalogue updating and standard production of images; image processing, value-added production, radiometric and geometric corrections, digital elevation model (DEM) production and ortho image production; computerized cartography; standard and higher-level processed imagery; and future Earth resource satellites.

13. While at Kiruna, participants made technical visits to a number of sites of interest, including the ESA/Salmijärvi and Esrange satellite receiving stations and the Kirunavaara underground mine. Lectures were supplemented by tours of the production facilities of Satellus.

14. The final part of the course concerned the development of remote sensing curricula and was held over a period of three days in Stockholm at the Department of Physical Geography. The participants worked in small groups set up on a regional basis and on the last day of this part of the course each group presented a sample remote sensing curricula project, which, in addition to educational content, included such components as necessary teaching staff and equipment and required budget. The participants also received and took back home sets of teaching materials, which included books, teacher's notes, slides and images.

III. Course evaluation

15. On the last day of the course, during a half-day evaluation session, participants made a formal presentation of the course evaluation to representatives of the Office for Outer Space Affairs, the Department of Physical Geography and several course lecturers. Discussions following the formal presentation made by a representative of the participants allowed additional inputs to be made by all participants.

16. During the discussions, the participants made some suggestions they believed would improve the programme of the course in the future. The main suggestions and recommendations made were as follows: (a) the duration of the course should be extended to up to one academic semester; (b) the digital image processing and GIS parts of the programme should be expanded; and (c) additional training in advanced technologies and microwave remote sensing should be organized on a regular basis as a follow-up to the programme.

17. As a precursor to the larger-scale exercise described in section IV below and in order to evaluate the local impact of the training courses, a questionnaire developed by the Office for Outer Space Affairs was distributed among the participants during the final part of the course. The questionnaire included questions on participation of educators from participants' institutions/universities in the previous United Nations/Sweden training courses from 1990 to 1999 and the impact of any training received on curriculum development and educational programmes in the respective institutions/universities.

18. Twenty-five participants completed the questionnaire, 15 of whom confirmed that at least one person from their respective institution/university had participated in a United Nations/Sweden training programme between 1990 and 1999. In 10 cases it was clearly indicated that training received by past participants of the course had led either to the introduction of new programmes on remote sensing or to the enhancement of existing programmes, or to new research and application projects at the respective academic institution.

19. The results of the Workshop on the Evaluation of the United Nations/Swedish International Development Agency International Training Course Series on Remote Sensing Education for Educators, organized jointly by the United Nations Programme on Space Applications and the Government of Sweden in Gaborone from 18 to 21 October 1998, were also discussed. The workshop had been organized with the primary aim of evaluating the series of training courses, held annually in Sweden since 1990 (except in 1991), and of determining the future direction the courses should take. Thirty-two academic-level teachers from African countries who had previously attended the training courses on remote sensing education for educators between 1990 and 1996 participated in the workshop and their experience in either introducing or enhancing remote sensing education in their own institutions was a major input to the workshop. Information on the programme and recommendations of the workshop as well as proposed follow-up actions can be found in the report of the workshop (A/AC.105/709).

20. In order to evaluate the general organization of the training programme, a questionnaire prepared by SIDA was distributed among participants during the final part of the course. A summary of the opinions of the participants extracted from the 17 questionnaires completed is as follows: (a) 59 per cent thought the course was right in length; (b) 18 per cent found the schedule too heavy; and 59 per cent thought the daily schedule was right; (c) 47 per cent found that the theoretical training corresponded to their professional needs to a large or very large extent; and 41 per cent said the same about the practical training; (d) 94 per cent found the overall level of the programme to be adequate from their personal professional point of view; (e) 82 per cent found that there were subjects not adequately covered in the programme, with most of them indicating digital techniques and GIS as being such subjects; (f) 71 per cent found the methods of instruction to be very good; and (g) 47 per cent thought that they would have an opportunity to apply the newly acquired knowledge and experience in their present employment to a great or very great extent.

21. The feedback received from the exercise will be taken into account in the development of the course programme for 2001, as, for example, recommendations made by participants in 1999 led to the extension of teaching in the practical use of GIS in 2000.

22. At the conclusion of the discussions the participants expressed their appreciation to the Government of Sweden, SIDA, the University of Stockholm and the United Nations for making possible their participation in the training programme.

IV. Proposed follow-up action

23. In order to obtain a better overview of the impact of the series of training courses on curriculum development and educational programmes at the local level, two questionnaires will be developed by the Office for Outer Space Affairs, in consultation with the University of Stockholm, by the end of 2000 and will be sent to all institutions and universities, members of whose staff have attended the courses. The questionnaires are intended to determine the results of the implementation at the local level of the knowledge and techniques acquired during the training programmes. The questionnaires will also examine successes and failures in introducing or enhancing remote sensing education in those institutions and the reasons for them.

24. The first questionnaire will target all former participants who attended any of the courses between 1990 and 2000. The second questionnaire will be sent to heads of departments or institutions/universities where former participants work. The "two-group" approach will provide a good picture of the contributions made by former participants in the development of remote sensing education programmes in their respective academic institutions.

25. Information from completed questionnaires will be processed jointly by the Office for Outer Space Affairs and the University of Stockholm in order to evaluate the local impact of the training courses and to enhance the effectiveness of the programme in the future, as well as to determine types of further training or academic assistance needed by former participants who are actively involved in remote sensing education.